

Two-dimensional ferromagnetism in Sr₂FeReO₆ thin film

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Two-dimensional (2D) magnets have garnered substantial attention for their immense application potential, playing a crucial role in the development of spintronic devices. However, the Mermin-Wagner theorem states that long-range magnetic order is extremely rare in 2D materials at finite temperatures [1]. A previous study reported that the double perovskite Sr₂FeReO₆ (SFRO) exhibits a room-temperature ferromagnetic insulating state within highly cation-ordered Fe-rich phases [2]. We have successfully synthesized cation-ordered SFRO on (001) (LaAlO₃)_{0.3} (Sr₂AlTaO₆)_{0.7} (LSAT) substrates. LSAT substrates have cation-ordered double perovskites, which could improve the cation ordering in SFRO thin film. With this enhanced cation ordering, we confirm the manifestation of ferromagnetic domains even in SFRO monolayer on atomically flat LSAT substrates by measuring magnetic force microscopy (MFM). As a result, we demonstrate the possibility of 2D ferromagnetism in ultrathin SFRO films, which gives rise to the way of utilizing in future spintronic devices.

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[2] C. Sohn, E. Skoropata, Y. Choi, X. Gao, A. Rastogi, A. Huon, M. A. McGuire, L. Nuckols, Y. Zhang, J. W. Freeland, D. Haskel, H. N. Lee, *Adv. Mater.*, 31, 1805389, (2019).